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COLLEGE OF ENGINEERING

Departments of

Aerospace Engineering  
Atmospheric and Oceanic Science

High Altitude Engineering Laboratory

Yearly Report  
1 July 1972 to 31 August 1973

ORA Project 033390

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This document has been prepared as a report of the progress made under NASA Grant NGR 23-005-360 during the time period 1 July 1972 through 31 August 1973.

### Summary

The auroral studies began in the last fiscal year were continued this year. The Michigan Airglow Payload was launched into a stable auroral form in February 1973.

The analysis of the data obtained on previous flights continued. The results of the first auroral flight (NASA 4.329) were reported. Additional results from the twilight flight (NASA 13.51) were reported.

The analysis of the stellar occultation data is now being done as a cooperative program with Dr. R. G. Roble of N. C. A. R.

The laboratory study of the optical emissions from the bottled aurora is near completion. An electron analyzer is built and measuring the energy spectrum of the degraded primary beam.

### Rocket Studies

#### 1. Auroral Study (NASA 4.330)

On the previous auroral flight, we found that the low energy electrons had a slight pitch angle dependence. Thus, in this flight we changed the entrance geometry of the electron energy analyzer such that better pitch angle measurements could be made. The mass spectrometer was adjusted to look for light ions in addition to the major ions.

The instruments were fully calibrated in the laboratory prior to launch. The payload was launched from Fort Churchill, Manitoba, Canada into an aurora of IBC I+ on February 27, 1973. It successfully penetrated the aurora on both up and down leg portions of the flight. All of the instruments worked properly. The data returned was high quality. The payload soft landed and was recovered the day after launch. It had hit on ice and part of

the inner structure was broken. The instruments were tested in the laboratory upon return from the field and all were working properly.

## 2. Data Analysis

During this time period, the data from NASA 4.329 was reduced. The HARP data from NASA 4.330 was reduced. Data reduction was begun on the other experiments of NASA 4.330.

The analysis of the twilight 6300 Å line obtained on NASA 13.51 is near completion and will be reported early in the next grant period. The analysis of the 3914 Å line obtained on the same flight has been submitted to the Journal of Geophysical Research. A comparison of the electron temperatures obtained by the Langmuir probe and the HARP on this flight has been accepted for publication by Planetary and Space Science in the fall of 1973.

The optical data from NASA 4.329 was presented at the Fall Meeting of the American Geophysical Union. Two channels of optical data giving information on  $O^+$  7319 Å and  $N_2^+$  3914 Å are being analyzed as part of a Ph. D. thesis by Gary Swenson.

### Laboratory Auroral Experiment

Measurements have been made of the spatial distribution of the energy lost by monochromatic beams of energy in molecular nitrogen. The beam energy ranged from .5 kilovolts to 5 kilovolts. Measurements were repeated at all energies to ensure consistency of results.

Luminosity distributions have been reduced, and the results compared with the work of Grün. It was found that the functional form of the range-energy relations was preserved, but absolute values differed in a manner which yields greater range at low energies than Grün would predict. The curves of equal luminosity had the same shape as those of Grün, but greater sensitivity allowed a greater range of intensity to be used.

A retarding potential energy analyzer is now being tested for use in the system. Its purpose is the measurement of the distribution in energy of electrons along the beam.

## Conclusion

This report has indicated the major areas of work that have been carried out under NASA Grant NGR 23-005-360 during Fy 1973. A list of publications sponsored in full or part by this grant is attached.

The research reported in this report represents a significant part of the atmospheric science program being carried out at the High Altitude Engineering Laboratory and is the nucleus of our upper atmosphere program.

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